

take-offs that often reached 90-99 dBA. By contrast, stations at Wonder Lake and the Tokositna Glacier recorded overflights at unknown distance that were usually in the range of 40-60 dBA.

Snowmobiles

Broad Pass Sound Monitoring Data (unpublished NPS data, 2000, courtesy Shan Burson)

Three days of audibility studies were conducted on the south side of the park near the Bull River and Cantwell Creek, in areas of heavy use near Broad Pass. Both weekdays and weekends were sampled. Two observers at locations three miles apart sampled seven hours on Wednesday, May 3, 2000, and Saturday, April 15, and four hours on Friday 21 April. Two sampling methods consisted of recording everything heard for ten seconds every five minutes, and everything heard for sequential 5-minute periods. Although a small sample size, the data were still suggestive of the percentage of time snowmobile noise is presently audible in this area.

Snowmobiles were audible during 0% of the 10-second and 5-minute intervals during a total of 14 hours on Wednesday. Snowmobiles were audible during 29% of the 10-second intervals and 44% of the 5-minute intervals during 8 hours on a Friday. Snowmobiles were audible during 71% of the 10-second intervals and 91% of the 5-minute intervals during 14 hours on a weekend day.

Noise Data from Snowmobile Pass-bys

In conjunction with the Winter Use Plan developed for Yellowstone and Grand Tetons National Parks, the consulting firm Harris Miller Miller & Hanson compared audibility and sound level for various kinds of winter transportation devices, including snowmobiles and snowcoaches. The study was mostly concerned with the audibility of noise from over-snow vehicles relative to the tonal frequency of the noise emitted, but particularly useful for the Denali plan was a comparison of measured sound levels of four-stroke and two-stroke snowmobiles. The comparison was accomplished by driving snowmobiles past a sound level meter at 50 feet while it recorded levels every 1/8 second; maximum values were taken from that data stream and averaged ( $L_{max}$ ). Four-stroke snowmobiles were distinctly quieter than two-stroke machines (Menge, et al., 2002).

Table 4-4: Comparison of Measured Sound Levels of 4-Stroke and 2-Stroke Snowmobile Pass-Bys at 50 feet.

	4-stroke engine		2-stroke engine	
Target Speed (mph)*	Average $L_{max}$ (dBA)	Median $L_{max}$ (dBA)	Average $L_{max}$ (dBA)	Median $L_{max}$ (dBA)
20	66.1	65.9	71.0	71.3
35	71.8	71.9	74.0	74.2
45	73.1	72.9	75.8	76.3
Acceleration	73.1	72.7	78.7	79.1

\* Average measured speed varied from target speed, but was very similar between 2-stroke and 4-stroke machines in all trials except the acceleration trial, in which 4-stroke machines averaged 27.4 mph and the 2-strokes 31.3 mph where vehicle was opposite the microphone.

NPS staff at Denali National Park and Preserve conducted similar pass-by tests using a 4-stroke Arctic Cat and a 2-stroke SkiDoo Skandic 500. These drive-by tests were conducted in 8” of powder with a 24” base, conditions that are more typical of the Denali backcountry snowmobile experience than the groomed trails used in the published experiment described above. Sound levels at 50 feet indicate a much greater difference between the 4-stroke and 2-stroke engines of these particular machines, as depicted in Table 4-5.

Distance Audible

An experiment was conducted on 21 April 2000 to determine the distance that a 2000 Skidoo Skandic 500cc snowmobile could be heard. The observer was positioned on the crown of a treeless hill in Denali National Park between the Bull River and Cantwell Creek with good visibility in all directions. From this point the observer was able to distinguish snowmobile noise from 2.5-3.5 miles away, depending on topography, wind, and vegetation. Light wind did not appear to influence